



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

PHILOSOPHICAL TRANSACTIONS.

For the Months of *August* and *September*.

Septemb. 21. 1674.

THE C O N T E N T S.

Microscopical Observations from Mr. Leeuwenhoeck, about Blood, Milk, Bones, the Brain, Spittle, Cuticula, Sweat, Fatt, Teares; communicated in two Letters to the Publisher. An Account of a notable Case of a Dropfy, mistaken for Gravitation in a young Woman; imparted by a Learned Physitian in Holland. An Account of three Books: I. DE S E C R E T I O N E A N I M A L I Cogitata, Auth. Guil. Cole, M. D. II. Erafmi Bartholini S E L E C T A G E O M E T R I C A. III. L O G I C A, five Ars Cogitandi; ex Gallico in Latinum Sermonem versa. Some Animadverfions upon the Latin Version, made by C. S. of the Phil. Transactions of A. 1665. 1666. 1667. 1668:

Microscopical Observations from M. Leeuwenhoeck, concerning Blood, Milk, Bones, the Brain, Spittle, and Cuticula, &c. communicated by the said Observer to the Publisher in a Letter, dated June 1. 1674.

Sir,

Yours of 24th of April last was very welcome to me; whence I understood with great contentment, that my Microscopical Communications had not been unacceptable to you and your Philosophical Friends; which hath encouraged

R

me

me to prosecute such Observations, concerning which I shall at present impart to you what follows :

1. The small Red Globuls in the Blood, formerly spoken of*, are heavier than the Crystalline liquor in See Numb. 102. which they are carried, because soon after that p. 23. the Blood is let out of the Veins, those Globuls by little and little subside towards the bottom ; and being made up of soft fluid Corpuscles, and many lying upon one another, they do unite themselves close together, and by this close conjunction the Blood that is under the surface alters its colour, and becomes dark-red or blackish ; as I have observed several times : of which I take the reason to be, (with submission to better Judgments) that the Air cannot move every way round about the Globuls, and hits as 'twere against a close darkish body. Touching the *Florid* red colour of the surface of the Blood exposed to the Air, that comes, in my opinion, from hence, that the *uppermost* Globuls are not press'd, and therefore retain their nature, and the Globuls *subjacent* to the uppermost lye close togerher, by reason of which close conjunction the Air or Light cannot penetrate through them, but is reflected, and so gives a greater light to, and about, the uppermost Globuls, than they had before the union of the inferior Glo- buls ; and this it is that makes them appear more florid.

2. I shall herewith communicate the Manner *how* I have observ'd, among other things, *Blood* and *Milk*. I did my self See Fig. I. prepare divers sorts of very slender hollow Glass- pipes, as A B, of which some were not thicker than a mans-hair ; and the slenderer they are, the clearer will they make the red Globuls of the Blood appear. But, for seeing the Crystalline water in which those Globuls move, and for observing also how they subside, these Pipes may be made somewhat thicker. Having then made ready such a small Pipe, I tye about the uppermost joyn't of (e. g.) my thumb a string, as is usual in opening a Vein of an Arm, and then I prick that part of my thumb with a pin, to make it bleed ; this blood I wipe off, if I intend to keep any for the Air. And then I look well to the place prick't, putting upon that point my Glass-pipe, and *withal* squeesing my thumb to press out more

Fig. 5.



Fig. 4.



Fig. 1.

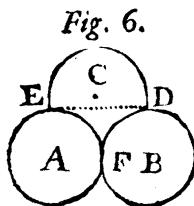


Fig. 6.



more blood; which being thus press'd out, will in part run up into the said pipe: This pipe with the blood in it, I lay upon a piece of white paper, and with my nail break a little

piece from it, as *Fig. 2^d* or *3^d*; and set it to the pin of my Microscope, having first a little wetted the pin with my spitle, or a little turpentine, to make the pipe stick to it; or else I take the whole Glafs-pipe, and with my hand hold it before the Microscope. Now in such a Glafs-pipe, the blood on the surface, and that which is under it, is almost of the same colour, although it stand a pretty while in it, because the Globuls in the Glass-pipe are but few, nor lie they so close together. The slenderer the pipe is, the higher will the blood rise into it. And that the Curious in your parts might themselves see this, I have used the freedom of sending you some of the said hollow Pipes, by the means of which I hope my above-mention'd speculations will be verified.

The red Globuls of the Blood I reckon to be 25000 times smaller than a grain of sand; which perhaps will to many seem incredible: But the matter being about figured Bodies, 'tis known, that, two Globes being given, the Axis of one whereof is 1, and that of the other, 20, the proportion between their magnitudes is as 1 to 8000; Spheres being in a triplicat proportion to their Diameters. The same red Globuls, when they are single, and stick within to the sides of the Glafs-pipes, will appear white and colourles.

3. Further, if your Curiosity shall lead you to observe the motion of those red Globuls thorow the Crystallin liquor, be pleased to take one of the thicker sort of these pipes: filling

See Fig. I. it with blood from E to F, and so putting the lower end B. a little into the flame of a Candle, and cloſing it hermetically. Which done, set the pipe upright, with the end A upwards, that so the red Globuls may sink. And desiring to see the motion of those Globuls, apply a little warmth to the pipe between F, B, making use only of a warm hand; by which warmth the Air betwixt F, B, must expand itſelf into a greater ſpace, and the blood in the pipe will be driven up higher; by which means the red Globuls will in part come to move above in the Crystallin humidity; yet if those Globuls come to joyn themſelves too close together, this Observation will fail.

4. I have several times endeavoured to observe the parts of a *Bone*, and at first I imagin'd, I saw on the surface of the Shinbone of a *Cow* several small veins (which bone I still keep by me,) but I have not found it since in any other bone. I thought likewise, I saw then also, that that Bone consisted of united Globuls. Afterwards I viewed the Shinbone of a *Calf*, in which I found several little holes, passing from without inwards; and I then imagined, that this Bone had divers small pipes going longwayes: But I have since observed the *Tooth* of a *Cow* and I found it made up of transparent Globuls which I can see very perfectly. The same I have observed in *Ivory* or *Elephants-Teeth*. And having seen this several times, I doubt no longer but that all white Bones do consist of transparent Globuls. Which being so, I am of opinion, that all things that appear white to our eyes are made up of nothing but transparent particles lying one upon another: Such as are Snow, white Paper, Linnen, white Stones, white Wood, Scum, beaten Glais, beaten Rosin, Sugar, Salt, &c.

5. Again, I have observed the *Liver* of a *Sheep*, and that of a fat platorick *Cow*; and they also consisted of very small Globuls, which appeared so little as those of Blood. The Liver of the *Cow* was of a Brown-red colour: yet viewing it in my Microscope, I found the particles, which I took from that Liver, to have but very little colour, only they were a little bright towards the red edge, and generally beset with very small Globuls of blood; and in some few places the blood lay vein-wise. Whence I cannot otherwise judge, but that these small particles of blood lay up and down dispersed through the Liver out of the veins. I caused part of those Livers to be boyled, esteeming, that by reaon of their natural softnes, all could not well be observ'd that might be remarkable in it; and I exposed it to dry somewhat hard; and thus in both of them I did see the Globuls: which I intend to observe yet further

6. The *Brains* of a Cow being viewed by me, I found the White substance thereof to be made up also of very fine Globuls. As for the Gray colour of the Brain, I have not as yet my self been able to observe any thing in it that is particular, by reason of its duskishnes. Now that the Curious may be assisted to view the particles of the brain, I herewith send also some Glass-pipes, by me contrived for that purpose. A See Fig. IV. B is a hollow Glass-pipe, A C is of the thicknes

of a course horse-hair. Its end from A to D, I thrust into the white of the Brain (having first open'd it with a Pen-knife,) and to the open end B, I apply my mouth, and there suck as strongly as I can, and during that suction I move the pipe by thrusting it inward and drawing it outward, so that the point A remains still moving in the white matter of the Brain: By which means I got a little of that part of the

* Perhaps it will be said, that Brain into my Glass-pipe, which I view the natural texture of the in the manner above-prescribed in the parts of the Brain, by bring forced into these small pipes, account of blood. But this I shall also is much altered and vitiated. observe again at my next conveniency*.

7. As to the *Marrow* of the Back-bone, I found that also to consist of very subtil Globuls; yet some few Globuls stood out, of a bigger size: Whence I doubted whether these bigger Globuls might not be caused by the labor of my suction and motion, having used the same way in viewing this Marrow, as I did in observing the Brain.

8. Having divers times observed the *Flesh* of a Cow, I found it to consist of very slender filaments, lying one by the other as if moven into a film. I have also viewed several filaments, which were beset with Globuls. These Globuls I judged to be blood, and that, pricking our body with a pin without hitting a vein, the bloody Globuls did issue from between these filaments: But this I leave to further consideration. Mean time I have with a pins point sever'd these filaments from one another, and found the single ones so fine, that any of them seem'd to me some 25 times thinner and finer than a hair. Having exposed them to my Microscope, I saw to my wonder, that they were made up of very small conjoined Globuls, which in smallnes seem'd to surpass all the rest. This I took notice

notice of frequently, being unwilling to take up any thing for truth, but what I have seen divers times, and in divers parts.

9. Having view'd *fasting Spitle*, I found in that fluid matter carried some few and those very small Globuls, of which I observ'd some to subside. I saw also therein several odd particles, some of which seem'd to consist of united Globuls. But looking upon the *Spitle* in the afternoon, I found those Globuls and odd Corpuscles in a greater number. I conclude hence, that all Bodies made out of Fluid matter do consist of Globuls; and am therefore of opinion, that if a drop of water could be placed in the free Air, it would be a perfectly round body and consequently, when out of any fluid matter in our body there are made consistent particles, that they also must be pressed together on all sides: Which pressure I esteem to be greater in our Body, than if the Water should press the Air, or the Air the Water. And by the same pressure the particles are likewise pressed together; whereupon must also ensue the roundness of their bodies.

10. The *Cuticula* or uppermost Skin of our Body consists of round parts or small scales, (as far as I have been hitherto able to judge:) And I fancy, that the continual growth of this *Cuticula* is made in this manner: If, for example, you let fall upon a white paper a little drop of Gum-water, the water will in a little time steam away, and the Gum will keep the surface of the drop. Now I imagine this Gum-water to be the humors, that are continually emitted out of our Body, whence the humidity issues forth from between all those round particles or scales lying close upon another, and not through pores, as many have taught. Like a close and well-twisted Cable, upon which pouring continually some water, this water will pass through the whole Cable and issue out at the end; not passing through any pores, but making its way about and between the filaments of the Cable, and so getting out beneath. And the courser or more consistent matter, which I compare to Gum, cleaves to the body, and so maketh the uppermost skin, which skin thus grows on from beneath and is worn off from above: And the more transparent these particles are, the whiter is our skin. Which yet are but our conjectures and suspitions. And the like

like manner of growing I have formerly said to have place in *Plants*; only with this difference, that, when the superfice of a moist Globul, which is given out of the Plant, is become somewhat stiff, the moisture is then propelled out of the upper end of the plant, and that by a continual succeſſion. Which kind of progresſ of growing I apprehend may in ſome manner be ſeen in the Pith of *Wood*, in *Cork*, in the Pith of *Membranes*, as alio in the White of a *Quill*; of which three laſt I have ſent you and your curious Friends ſome small particles, cut off with a sharp Pen-knife, thinking it well worth their obſervation. Only I would here adverteſe, that when any of these particles is applied to the pin of ſuch a kind of Microſcope as mine is, the instrument may be held within doors and in the ſhade, yet held to the free Air, as it with a Telescopē you would look upon the Stars in the Firmament.

Other Observations made by Mr. Leeuwenhoeck, about Sweat, Fatt, Teares ; imparted to the Publisher in a Letter of July the 6th 1674.

1. I Have often viewed the *Sweat* of my face, which conſifted of a Crystallin moisture, in which I ſaw ſome, but very few, transparent Globuls, as alio a very few, but bigger and odd particles of diſtinct forms, which latter I esteem to be particles ſcaled off from the *Cuticula* or uppermoſt ſkin.

2. I have alſo obſerv'd the *Sweat* of ſeveral Horſes; firſt in ſuch, as ſweat but a little, yet ſo that I could wipe off ſome drops of Sweat from their heads: In which I ſaw likewiſe ſome Globuls ſwimming in the Crystallin humidity, as alio ſome odd bigger parts: But then in Horſes that had labour'd harder, or run more violently, and ſweat ſo as that white sweat-drops run from their body, I ſaw in them a great abundance of Globuls moving in the Crystallin moisture, together with ſome of thole odd bigger parts, which I likewiſe judged to be ſcalings off from the *Cuticular*.

3. Heretofore I acquainted you, that I imagined to have ſeen *Hair* as made up of united Globuls, and to have alſo obſerv'd *Elephant's hair* to conſiſt of the like. I cannot omit now

now to communicate unto you, that since that time I have seen such Globuls not only in *Man's* and *Horse-hair*, but also frequently in the *Wool of Sheep*; and further, that the *Root* of the hair pull'd out of my *Eye-brows* consists altogether of the like Globuls.

4. Having pull'd out of an Elephants-tayl a black Hair, and cut transversly from it a thin scale, I expos'd it to my Microscope, which represented in the thick of that Hair about an hundred little specks somewhat whitish, and in each speck a black point, and in some few of those black points, a little hole; and this hair consisted withal of united Globuls, which yet I thought I should have found bigger in this thick hair of so bulky a Beast, than indeed they were. This Scale I keep still by me because of its curious and elegant appearance, not unlike (excepting the Colours) a Peacocks-tayl.

5. I have formerly sent you my way of seeing the motion of the Globuls in the Crystallin liquor of the *Blood*: Having since contrived a more convenient Glass-pipe for that purpose, I cannot but give you and your Curious Friends notice thereof; *viz.* A B is a hollow Glass-pipe from B to O, about the thickness of a course horse-hair; from O to D, about the thickness of a Pigeons-quil, and the thickness from D to A somewhat slenderer, *ad placitum*. 'Tis open on both its ends, A and B: Into this pipe I brought some Blood from E to F, or from E to C, and then seal'd the end A hermetically: Or else, I leave the pipe closed at A, and by the application of my hand or breath bring a little warmth to the thickest part of the Glass G, holding the pipe with my two fingers at F, and so conveying its open end B to the Blood, &c. Whereupon some of the Air in the pipe, being by the said warmth driven out at the open end B, it will immediately indeavour to have its former state, and so attract a little blood into the slenderer part of the pipe: which pipe I then put from A to G into a small Copper-pipe, which I had caused to be fitted to one of my Microscopes, and which I can move at pleasure, nearer or further off, higher or lower.

6. I did lately view \dagger some Blood, in which \dagger *In one of the new-there was much of that Crystallin liquor, and by described pipes.*

going into the open Air, at a time when there were pretty strong gusts of wind, I saw, to my great delight, continually, and without any other motion but that of the wind, the red Globuls agitated pesle-mesle, and as if each Globul had yet a second motion, and that about its axe.

7. I shewed to Mr. C. H. and couched in writing, how I had observ'd the Blood, &c. furnishing him also some of those small Glafs-pipes ; which together with my Letter being sent by him to his Son at *Paris*, he had this return from him, that they had seen no Globuls at all in the blood, but other particles. This may happen also to others, who are therefore hereby advertifed that thole red Globuls, standing still, do soon come to stick to one another, (as I have observ'd my self more than once,) and being thus carried thorow the Crystallin humidity, exhibit odd and mishapen particles : Which doubtless is the reason, why the said Globuls were not seen by the above mention'd person, and why indeed they cannot be seen in that case.

8. These small Glafs-pipes, which I am wont to observe any fluid matter with, are closed by me on both ends ; and when I come to make use of them, I break off with my nail the closed ends, that so the Earthy particles, that swim continually in the Air, may not get into the pipes, having frequently found, that when those pipes have been open a while in the Air, they are in many places beset with earthy particles and filaments, which, without this precaution, might be taken for parts of the matter itself that is under observation.

9. I have heretofore view'd the *Fatt* of Mutton and Cows, and shew'd to several of the Curious, that it is made up of Globuls joyn'd together, which appear'd to my eye, as big as ordinary hail-stones : Yet are we not to fancy, as if these Globuls, and those that constitute a Bone and other solid parts, did consist of Globuls *perfectly* round : For, if that were so, it must follow, that the interstices betwixt such Globuls would be triangular, or they be fill'd up with other Corpuscles. But you are to know, that they are round but on one fide ; as, *for example*, See *Fig. VI.* A and B are two Globuls of Fat, that are formed first, and the third being a forming, and to be placed between and above A and B, it will take the form of C, and so

so make up the triangular body FDE, as in the *Fig.* annext. And thus I think I see the grosser parts of Fat, not perfectly round. And if any of the Curious desire to see the Globuls, of which the greatest parts of Fat are made up, they may be pleased to take care, that there be taken a piece of the coarsest Fat, and that with the hand it be broken asunder; which way being observ'd, there will then (yet not always) some small particles of fat, in the midst of the fat, be sever'd, which being dextrously applied to the pin of the Microscope, you will be able to see its form: For if you break off a piece of fat with a pin, you will tear the Globuls.

10. I have lately observ'd, that each buble or globul of Fat consists of more than a thousand small Globuls. Yet I am apt to believe, that those that have not seen the Globuls in Blood, Hair, Bone, &c. will not satisfie themselves about seeing the Globuls in the Globuls of Fat, because of their extraordinary minuteness.

11. The *Fat* of some *Water-jouls* and *Fish*, though it have been view'd by me, yet shall I endeavor to observe it again before communication.

12. Having view'd the *Teares* of two infants, I found therein very few round Globuls, but much more other odd and misshapen particles, of divers forms; some of which seem'd to consist of united Globuls. I was thinking, because those Tears had run down the Cheeks, whether all these particles might not be scalings off of the Cuticle. For I presume, if the Tears of a grown person, and such as are caused from much grief, and are shed copiously, were well viewed, there would in all appearance be much more seen in them.

An Account of a notable Case of a Dropſy miſtaken for Gravidation in a young Woman; communicated by a Learned and Inquisitive Physician in Holland, considerably enlarging the Observation made of the ſame Case by the famous Dr. Tulpius, lib. 4, Obj. c. 48.

SOME years ſince, there came to Dr. D. a young Woman of about 17 years of age, unmarried and reputed a Maid, of a florid countenance, and strong body, having a good ſtomach, periodice menstruata, and wanting none of other due evacuations;